Physics Aptitude Test Guide

The Physics Aptitude Test is Oxford’s admissions test for the following courses:

* Physics
* Physics and Philosophy
* Engineering Science
* Materials Science

It takes place in early November, and is the primary indicator used to shortlist candidates for interview.

# Structure of the test

The PAT is a 2 hour long exam, split evenly between maths and physics. The maths section is 50 marks of independent, written questions, ranging from about 3-8 marks. The physics section comprises 10 marks of multiple choice questions, 20 marks for independent written questions and 20 marks for a long question of multiple parts which all lead into one another.

The test is marked out of 100, and around 500 students who scored the best are invited for interview. This shortlisting mark is usually around 55.

# Preparing for the PAT

The questions on the PAT generally use A-level content, but presented in a more challenging way. You’re also not allowed calculators or formula sheets, so overall many people find adjusting to the style of the PAT challenging. The best advice for preparation is to make sure that you’re really confident with the AS level syllabus, and to commit formulae and important trigonometry identities to memory. Also, there are some elements of the PAT, such as specific heat capacity and Archimedes principle that are not covered in AS physics, so you’ll need to familiarise yourself with those. It’s a good idea to start doing some past papers over summer, as there’s only two months to prepare once you come back in September. You can find past papers at <http://www2.physics.ox.ac.uk/study-here/undergraduates/applications/physics-aptitude-test-pat/pat-past-papers>, and college has a set of model answers, although these are not available online.

# PAT Syllabus

## Maths

Elementary mathematics: knowledge of elementary mathematics, in particular topics in arithmetic, geometry including coordinate geometry, and probability, will be assumed.

Algebra: properties of polynomials, including the solution of quadratics. Graph sketching and transformations of variables. Inequalities and their solution. Elementary trigonometry including relationships between sin, cos and tan (sum and difference formulae will be stated if required). Properties of logarithms and exponentials. Arithmetic and geometric progressions and the binomial expansion.

Calculus: differentiation and integration of polynomials including fractional and negative powers. Differentiation as finding the slope of a curve, and the location of maxima, minima and points of inflection. Integration as the reverse of differentiation and as finding the area under a curve. Simplifying integrals by symmetry arguments.

Physics: knowledge of elementary physics will be assumed. Questions may require the manipulation of mathematical expressions in a physical context.

Relationship to existing UK qualifications: Candidates who have studied mathematics at GCSE and AS level (including the first two core pure modules) should be familiar with the great majority of the syllabus.

## Physics

Mechanics: distance, velocity, speed, acceleration, and the relationships between them. Interpretation of graphs. Response to forces; Newton's laws of motion; weight and mass; addition of forces; circular motion. Friction, air resistance, and terminal velocity. Levers, pulleys and other elementary machines. Springs and Hooke's law. Kinetic and potential energy and their inter-conversion; other forms of energy; conservation of energy and momentum; power and work.

Waves and optics: longitudinal and transverse waves; amplitude, frequency, period, wavelength and speed, and the relationships between them. Basic properties of the electromagnetic spectrum. Reflection at plane mirrors. Refraction and elementary properties of prisms and optical fibres including total internal reflection. Elementary understanding of interference and diffraction.

Electricity and magnetism: current, voltage (potential difference), charge, resistance; relationships between them and links to energy and power. Elementary circuits including batteries, wires, resistors, filament lamps, diodes, capacitors, light dependent resistors and thermistors; series and parallel circuits. Elementary electrostatic forces and magnetism; electromagnets, motors and generators. Current as a flow of electrons; thermionic emission and energy of accelerated electron beams.

Natural world: atomic structure. Structure of the solar system. Phases of the moon and eclipses. Elementary treatment of circular orbits under gravity including orbital speed, radius, period, centripetal acceleration, and gravitational centripetal force. Satellites; geostationary and polar orbits.

Mathematics: knowledge of elementary mathematics will be assumed. Questions may require the manipulation of mathematical expressions in a physical context.

Problem solving: problems may be set which require problem solving based on information provided rather than knowledge about a topic.

Relationship to existing UK qualifications: Candidates who have studied physics at Higher Tier GCSE or AS level should be familiar with the great majority of the syllabus.